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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
SINGH, PREM C	
ART UNIT	**PAPER NUMBER**
1764	

DATE MAILED: 12/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/732,877	JIANG ET AL.	
	Examiner	Art Unit	
	Prem C. Singh	1764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) *1-12* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *13-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *06/01/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

   I. Claims 1-12, drawn to a reactor system for hydrocarbon processing, classified in class 422, subclass 231.

   II. Claims 13-37, drawn to a method of oxidation of hydrocarbons, classified in class 585, subclass 733.

The inventions are distinct, each from the other because of the following reasons:

Inventions in Group II and I are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the process of oxidation of hydrocarbons can be carried out by a materially different apparatus, for example, a fixed bed reactor.

Because these inventions are independent or distinct for the reasons given above and because the inventions have acquired a separate status in the art in view of their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Attorney Derek V. Forinash on 11/22/06 a provisional election was made without traverse to prosecute the invention of claims 13-37.

Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-12 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 13-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hills (US Patent 4,269,791.

6. With respect to claim 13, Hills discloses a technique for providing a mixture of a plurality of gases. Hills discloses, "The invention employs a plurality of needle injectors which provide each gas to a column of liquid. The needle injectors are coupled to sources of the gases to be mixed, such as hydrogen and oxygen, and regulated so that the total volume of gas delivered to the injectors will be maintained at a specific ratio for controlling the end mixture. The column of liquid is then caused to have a turbulent flow at one portion to provide a mixing region for the gases. The gases in the turbulent region transfer through the liquid boundary between the bubbles in the column of liquid

until equilibriation occurs." (Column 2, lines 22-33). "The final gas concentration at the output of the mixing chamber may then be used to directly supply the correct ratio of gas mixture for use on site." (Column 2, lines 43-45).

Although Hills does not specifically mention about supplying the reactant gas mixture to a reaction zone, the invention does mention to supply the gas mixture for use on site, thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention and take the mixture of gases to a reaction zone to produce products from the reactant gases.

7. With respect to claim 14, Hills discloses, "The diameter of the injectors can be controlled to produce any desirable diameter bubble" (Column 3, lines 31-33).

Although Hills does not specifically mention about the superficial velocity of gases, the invention does disclose controlling the bubble diameter from the nozzles. Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention and control the superficial velocity within a suitable range (including 5-60 cm/s, as claimed) to produce desirable diameter bubbles for proper mixing in the tank.

8. With respect to claim 15, Hills discloses a pump (14) (see figure) so that a continuous flow is provided throughout the enclosure (13) (see column 3, lines 13-14). Hills also discloses, "The column of liquid is then caused to have a turbulent flow at one portion to provide a mixing region for the gases." (Column 2, lines 29-31).

9. With respect to claim 16, Hills discloses use of hydrogen and oxygen in the invention. Although the invention does not specifically mention using a hydrocarbon gas, the invention does mention, "The device can be used to provide on-site mixtures of hydrogen-oxygen or any other gases for storage or on-site use that would normally exhibit explosive tendencies following mixing." (Column 5, lines 5-8). Since a mixture of oxygen and hydrocarbon gases is explosive similar to a mixture of oxygen and hydrogen, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention and substitute hydrogen by a hydrocarbon gas and prepare a mixture of hydrocarbon gas and oxygen for downstream processing and avoid any explosion.

10. With respect to claims 17 and 18, Hills does not specifically mention oxygen to carbon molar ratio.

As discussed under claim 16, use of hydrocarbon gas would have been obvious to one skilled in the art. Knowing the hydrocarbon gas, the molar ratio of oxygen to carbon can be easily calculated.

11. With respect to claim 19, Hills does not specifically mention the pressure in the tank.

The invention does mention using a turbulent condition in the liquid and mixing of two gases, thus the system must be under pressure. Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills

invention and specify the pressure in the tank for proper control of the turbulent conditions and mixing of two gases.

12. With respect to claim 20, Hills does not specifically mention the aspect ratio of the tank.

The invention discloses, "The length of the water column must be such as to allow substantially complete equilibriation between bubbles to occur over the distance traveled by the bubbles prior to their withdrawal." (Column 3, lines 49-52). Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention and use a proper height-to-diameter ratio (i.e., aspect ratio) of the column, including the claimed range of 1-15, to achieve complete equilibrium between bubbles.

13. With respect to claim 21, Hills discloses, "The mixture is then withdrawn from the system at exit port (18) where it may be used to continuously supply gas for other purposes as may be required." (Column 3, lines 46-49).

Although, Hills does not specifically mention heating the reactant gas mixture, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention and use heated gas mixture where needed, and thus produce different reaction products from the hydrocarbon gas and oxygen.

14. With respect to claim 22, Hills discloses, "In operation, the pump (14) provides the turbulent flow of liquid, in this case water, to the base of the enclosure (13)." (Column 13, lines 23-25).

15. Claims 23-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hills (US Patent 4,269,791) in view of Hershkowitz et al (US Patent 5,883,138).

16. Claim 23 has all the limitations of claim 16, and in addition, requires supplying at least a portion of the reactant gas mixture to a reactor, and reacting at least a portion of the hydrocarbon gas with oxygen to form a reaction product.

Hills does not specifically mention using a reactor.

Hershkowitz invention uses an injector/reactor apparatus and efficient process for partial oxidation of light hydrocarbon gases. Hershkowitz discloses, "The process involves providing pressurized, preheated sources of a light hydrocarbon gas such as methane and oxygen and injecting said individual gases at high velocity through injector manifold." (Column 4, lines 42-49). Hershkowitz further discloses that methane and oxygen react in a catalytic reactor producing synthesis gas (see column 4, lines 56-67; column 5, lines 1-5).

It is to be noted that Hershkowitz uses a similar arrangement for mixing methane and oxygen as that used by Hills, with the only difference that Hershkowitz setup does not contain a liquid column for mixing methane and oxygen. Use of a liquid column is necessary to allow substantial equilibrium between bubbles, and also the liquid will be

continuously recycled by the pump (14) to maintain the turbulent flow as is required to provide the desired mixing (see Hills, column 3, lines 49-55). Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention, substitute hydrogen with methane, take the mixture of methane and oxygen from Hills setup and react in the partial oxidation reactor of Hershkowitz setup to produce synthesis gas.

17. Claims 24 and 25 have all the limitations of claims 14,16, and 23 and discussed before.

18. Claim 26 has all the limitations of claims 15,16, and 23, and already discussed before.

19. Claim 27 has all the limitations of claims 16,19, and 23, and already discussed before.

20. Claim 28 has all the limitations of claims 20 and 23, and already discussed before.

21. Claims 29 and 30 have all the limitations of claims 17,18, and 23.

Hills does not disclose O_2–to-carbon molar ratio.

Hershkowitz discloses O_2–to-carbon molar ratio from 0.3 up to 0.8 to 1 mole of (C). (see column 4, lines 51-52).

As discussed under claim 23, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention and use methane or any light hydrocarbon gas with an appropriate O_2–to-carbon molar ratio, including in the claimed range, for a proper mixture of hydrocarbon gas and oxygen to make synthesis gas.

22. With respect to claim 31, Hills does not disclose heating the reactant gas mixture.

Hershkowitz discloses using a preheated mixture of oxygen and methane gas (see column 5, lines 20-22).

Since preheating the mixture of hydrocarbon gas and oxygen will increase the reaction rate in the partial oxidation reactor, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention and use methane in place of hydrogen, preheat the mixture and then take to the partial oxidation reactor to produce synthesis gas.

23. With respect to claims 32 and 33, Hills does not disclose using hydrocarbon liquids.

The invention discloses, "In operation, pump (14) provides the turbulent flow of liquid, in this case water." (Column 3, lines 23-24). This means that the liquid may be other than water. Thus, it would have been obvious to one skilled in the art at the time

the invention was made to modify Hills invention and use a hydrocarbon liquid instead of water. Since hydrogen has been replaced by a hydrocarbon gas (as discussed under claims 16 and 23), a hydrocarbon liquid is available on-site as a result of reaction between the hydrocarbon gas and oxygen producing synthesis gas, which is subsequently converted to methanol and methanol-based products (see Hershkowitz, column 13, lines 42-47) and therefore, the hydrocarbon liquid can be used in the tank avoiding use of water which has to be obtained from outside sources.

24. With respect to claims 34 and 35, Hills does not disclose partial oxidation reactor and catalyst.

Hershkowitz discloses, "A process for the catalytic partial oxidation of light hydrocarbon gases such as methane to synthesis gas for subsequent hydrocarbon synthesis." (Column 4, lines 39-42).

Since Hills uses hydrogen and oxygen, but suggests that any gas can be used, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention and substitute methane for hydrogen and take the mixture to the partial oxidation reactor as disclosed by Hershkowitz to produce synthesis gas.

25. Claim 36 has all the limitations of claim 23, and additionally, requires the gas mixture to contain a portion of liquid.

As disclosed by Hershkowitz, the mixture of methane and oxygen is going to the partial oxidation reactor at a velocity between 25 and 1000 ft/sec (see column 4, lines

61-62), some liquid is bound to be entrained with the gaseous mixture at such a high velocity. Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention and take the gaseous mixture entrained with the liquid to the partial oxidation step as disclosed by Hershkowitz to produce synthesis gas.

26. With respect to claims 37, Hills does not disclose producing C_5+ hydrocarbons.

Hershkowitz discloses, "The treated synthesis gas may be used to produce methanol and methanol-based products, hydrocarbon synthesis products such as liquid hydrocarbons, olefins, alcohols and aldehydes, oxo-synthesis products, ammonia and ammonia-based fertilizers and chemicals, etc." Column 13, lines 42-46).

As discussed under claim 23, it would have been obvious to one skilled in the art at the time the invention was made to modify Hills invention and take methane and oxygen in Hills setup, produce a mixture of gases, feed to the Hershkowitz setup of partial oxidation, produce synthesis gas, and subsequently, produce different hydrocarbon products, including C_5+ hydrocarbons, as disclosed by Hershkowitz to make an integrated process for producing methanol and other useful products starting with methane and oxygen.

Conclusion

27. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Marion, US Patent 3,816,332.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Prem C. Singh whose telephone number is 571-272-6381. The examiner can normally be reached on MF 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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